

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US04/020767

International filing date: 28 June 2004 (28.06.2004)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/482,460
Filing date: 26 June 2003 (26.06.2003)

Date of receipt at the International Bureau: 30 August 2004 (30.08.2004)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)



World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse

1215328

TO AND TO WHOMSOEVER PRESENTS: SHANE CONNELL

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

August 21, 2004

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM
THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK
OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT
APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A
FILING DATE.

APPLICATION NUMBER: 60/482,460
FILING DATE: June 26, 2003
RELATED PCT APPLICATION NUMBER: PCT/US04/20767

Certified by

Jon W Dudas

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the U.S.
Patent and Trademark Office



Please type a plus sign (+) inside this box →

PTO/SB/18 (8-00)

Approved for use through 10/31/2002. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

PTO
13132 U.S.
160/48240

06/26/03

INVENTOR(S)		
Given Name (first and middle if any)	Family Name or Surname	Residence (City and either State or Foreign Country)
Patrick K.	Sullivan	Honolulu, Hawaii
<input type="checkbox"/> Additional inventors are being named on the _____ separately numbered sheets attached hereto		
TITLE OF THE INVENTION (280 characters max)		
Radiation Stress Non-Invasive Blood Pressure Method		
Direct all correspondence to: CORRESPONDENCE ADDRESS		
<input type="checkbox"/> Customer Number	→	
OR <input type="checkbox"/> Place Customer Number Bar Code Label here		
<input checked="" type="checkbox"/> Firm or Individual Name	James C. Wray	
Address	1493 Chain Bridge Road	
Address	Suite 300	
City	McLean	State VA ZIP 22101
Country	US	Telephone (703) 4424800 Fax (703) 448-7397
ENCLOSED APPLICATION PARTS (check all that apply)		
<input checked="" type="checkbox"/> Specification Number of Pages	8	<input type="checkbox"/> CD(s), Number
<input checked="" type="checkbox"/> Drawing(s) Number of Sheets	3	<input type="checkbox"/> Other (specify)
<input type="checkbox"/> Application Data Sheet. See 37 CFR 1.76		
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)		
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27.	FILING FEE	
<input checked="" type="checkbox"/> A check or money order is enclosed to cover the filing fees	AMOUNT (\$)	
<input type="checkbox"/> The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: _____	\$80.00	
<input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.		
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.		
<input checked="" type="checkbox"/> No.		
<input type="checkbox"/> Yes, the name of the U.S. Government agency and the Government contract number are: _____		

Respectfully submitted,

SIGNATURE


James C. Wray

Date 06/26/03

TYPED or PRINTED NAME

REGISTRATION NO.
(if appropriate)
Docket Number:

22,6933

TELEPHONE

(703) 442-4800

OCEANIT

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is provided by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

FEE TRANSMITTAL for FY 2003

Effective 01/01/2003. Patent fees are subject to annual revision.

 Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$ 80.00)

Comptee if Known

Application Number	
Filing Date	06/26/2003
First Named Inventor	Patrick K. Sullivan
Examiner Name	
Art Unit	
Attorney Docket No.	OCEANIT

METHOD OF PAYMENT (check all that apply)

 Check Credit card Money Order Other None
 Deposit Account:

Deposit Account Number	
Deposit Account Name	

The Commissioner is authorized to: (check all that apply)

Charge fee(s) indicated below Credit any overpayments
 Charge any additional fee(s) during the pendency of this application
 Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity	Small Entity	Fee Code (\$)	Fee Code (\$)	Fee Description	Fee Paid
1001 750	2001 375			Utility filing fee	
1002 330	2002 165			Design filing fee	
1003 520	2003 260			Plant filing fee	
1004 750	2004 375			Reissue filing fee	
1005 160	2005 80			Provisional filing fee	80
SUBTOTAL (1)		(\$ 80.00)			

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

Total Claims	Independent Claims	Extra Claims	Fee from below	Fee Paid
		-20* =		
		- 3** =		

Large Entity	Small Entity	Fee Description
1202 18	2202 9	Claims in excess of 20
1201 84	2201 42	Independent claims in excess of 3
1203 280	2203 140	Multiple dependent claim, if not paid
1204 84	2204 42	** Reissue independent claims over original patent
1205 18	2205 9	** Reissue claims in excess of 20 and over original patent
SUBTOTAL (2)		(\$)

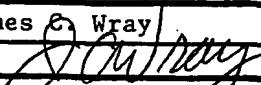
*or number previously paid, if greater. For Reissues, see above

3. ADDITIONAL FEES

Large Entity	Small Entity	Fee Code (\$)	Fee Code (\$)	Fee Description	Fee Paid
1051 130	2051 65			Surcharge - late filing fee or oath	
1052 50	2052 25			Surcharge - late provisional filing fee or cover sheet	
1053 130	1053 130			Non-English specification	
1812 2,520	1812 2,520			For filing a request for ex parte reexamination	
1804 920*	1804 920*			Requesting publication of SIR prior to Examiner action	
1805 1,840*	1805 1,840*			Requesting publication of SIR after Examiner action	
1251 110	2251 55			Extension for reply within first month	
1252 410	2252 205			Extension for reply within second month	
1253 930	2253 465			Extension for reply within third month	
1254 1,450	2254 725			Extension for reply within fourth month	
1255 1,970	2255 985			Extension for reply within fifth month	
1401 320	2401 160			Notice of Appeal	
1402 320	2402 160			Filing a brief in support of an appeal	
1403 280	2403 140			Request for oral hearing	
1451 1,510	1451 1,510			Petition to institute a public use proceeding	
1452 110	2452 55			Petition to revive - unavoidable	
1453 1,300	2453 650			Petition to revive - unintentional	
1501 1,300	2501 650			Utility issue fee (or reissue)	
1502 470	2502 235			Design issue fee	
1503 630	2503 315			Plant issue fee	
1460 130	1460 130			Petitions to the Commissioner	
1807 50	1807 50			Processing fee under 37 CFR 1.17(q)	
1806 180	1806 180			Submission of Information Disclosure Stmt	
8021 40	8021 40			Recording each patent assignment per property (times number of properties)	
1809 750	2809 375			Filing a submission after final rejection (37 CFR 1.129(a))	
1810 750	2810 375			For each additional invention to be examined (37 CFR 1.129(b))	
1801 750	2801 375			Request for Continued Examination (RCE)	
1802 900	1802 900			Request for expedited examination of a design application	
Other fee (specify)					

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$)

SUBMITTED BY		(Complete if applicable)		
Name (Print/Type)	James C. Wray	Registration No. (Attorney/Agent)	22,693	Telephone (703) 442-4800
Signature		Date	06/26/2003	

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization in PTO-2038.

This collection of information is required by 37 CFR 1.17 and 1.27. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, Washington, DC 20231.

RADIATION STRESS NON-INVASIVE BLOOD PRESSURE METHOD

BACKGROUND OF THE INVENTION

Current methods for measurement of blood pressure and other vital signs are inefficient.

Many measurements of patient vital signs are invasive procedures that are uncomfortable or inconvenient for the patient. Typically, the measurement of blood pressure requires the use of a cuff around the arm of a patient and is a non-continuous "spot-check" that does not reflect the true state of patient physiology.

Needs exist for improved methods of continuous non-invasive blood pressure measurements.

SUMMARY OF THE INVENTION

The present invention is a system that provides non-invasive, real-time, continuous collection and processing of signals from a patient to determine the current condition of the patient. The present invention relates preferably to the measurement of blood pressure. This measurement includes the average, mean, systolic and diastolic arterial blood pressure. However, the present invention is not limited to the measurement of blood pressure; other vital signs can be measured and processed as well. The present method also provides for continuous, non-invasive monitoring of hypertension and other related medical conditions.

The present invention uses acoustic, electromechanical or other related physiological signals collected from a patient. To operate the monitoring device, the patient engages a discretized, discrete, separated sensors in one or more discrete sensing arrays installed in a bed, chair or any other equipment that the patient will use. The patient lies down on, sits on, stands on, or otherwise engages the discretized sensing array, and signals are monitored over a range of

frequencies or at a specific frequency. Data is collected as a time series or another similar method. Data is transferred to a computing device in the form of a voltage signal via wire, fiber optics or wireless technology.

The energy spectra of each array point are determined and then are used to determine the variance of each array. Computational analysis of the data collected is used to determine energy momentum flux of blood flowing through the patient. Non-time series methods are used to determine energy at various array points or at a combination of array points. Momentum flux is determined from the data collected by the discretized separate sensors in each array. Blood pressure is related to the momentum flux through a mathematical algorithm. A computing device performs the computation of blood pressure.

These and further and other objects and features of the invention are apparent in the disclosure, which includes the above and ongoing written specification, with the claims and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram of the monitoring system with a discretized array.

Figure 2 is a diagram of energy spectra collected from location 1 to location n.

Figure 3 is a schematic representation of a person lying on an array of sensors.

Figures 4 and 5 are schematic representations of portions of sheets with sensor arrays.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a system that provides real-time, continuous collection and processing of signals from a patient to determine the condition of the patient. The present

invention relates preferably to the measurement of blood pressure. The measurements include the average, mean, systolic and diastolic arterial blood pressure. The present invention is not limited to the measurement of blood pressure; other vital functions, for example, heart rate and pulses and electrical signals, can be measured and processed as well. The present method provides for continuous, non-invasive monitoring of hypertension and other related medical conditions.

Figure 1 shows a diagram of a monitoring system 1 and a discretized array 3 of separate sensors 9. The present invention uses acoustic, electromechanical or other related physiological signals collected from a patient 5 in contact with the discretized sensors in the sensing array 3. The discretized sensing array 3 is a relatively flat device 7 with individual sensing arrays 9 dispersed throughout the surface of the discretized sensing array 3. The patient 5 lies down on, stands on, or otherwise engages the discretized sensing array 3, and signals are monitored over a range of frequencies or at a specific frequency, as shown in Figure 3. Data is collected as a time series or another similar method. Data is collected from individual sensing arrays 9, from grid locations 1 to n, via acoustic, electromechanical or other physiological signals.

The discretized sensing array 3 can have sensors arranged in various regular or irregular configurations. Figure 4 and Figure 5 show different arrangements of individual sensors 9 on a portion of the large discretized sensing array.

The discretized sensing array 3 provides time series data that is analyzed to produce energy spectra at locations 1 to n, as shown in Figure 2. The data is used to determine the variance of the time series signals. Computational analysis of data collected is used to determine momentum flux of energy through the patient.

Blood pressure is related to the momentum flux through a mathematical model. The

following relationship relates the incoming data to blood pressure:

$$Pa = K * (E1 - En) = \text{Average pressure due to excess flow of momentum}$$

Pa = Average blood pressure

K = Constant

E1 = Summation of energy spectra (area under the curve – variance of time series)

at location 1 x Pulse wave velocity

En = Summation of energy spectra (area under the curve – variance of time series)

at location n x Pulse wave velocity

A computing device performs the computation of blood pressure. The results of computation are output to the user.

The radiation stress, non-invasive blood pressure device of the present invention uses time series analysis and computational methods to process acoustic, electromechanical or other physiological signals from the patient. An energy spectrum is created by the sensing arrays to calculate the variance. The variance is the area under the energy spectra curve. Non-time series methods are used to determine energy at various array points.

While the invention has been described with reference to specific embodiments, modifications and variations of the invention may be constructed without departing from the scope of the invention, which is described in the following claims.

Claims:

1. A radiation stress, non-invasive vital sign monitoring method comprising:
 - providing a discretized array,
 - collecting acoustic, electromechanical or other physiological signals with the discretized array,
 - transmitting signals to a receiving and computing device,
 - producing time series data from various locations on the array,
 - calculating energy spectrum,
 - determining variance of each array,
 - calculating a value for a vital sign of a patient.
2. The method of claim 1, wherein the collecting acoustic, electromechanical or other physiological signals further comprises contacting of the discretized array by the patient.
3. The method of claim 2, further comprising lying on, standing on, or otherwise engaging of the discretized array by the patient.
4. The method of claim 1, further comprising collecting data over a range of frequencies or over a single frequency.
5. The method of claim 1, wherein the collecting acoustic, electromechanical or other physiological signals further comprises collecting data in a time domain or frequency domain.
6. The method of claim 1, further comprising calculating a value for a vital sign with non-time series methods for determining energy at various array points or a combination of array points.
7. The method of claim 1, wherein the transmitting of signals comprises transmitting voltage signals via wire, fiber optics or wirelessly.

8. The method of claim 1, further comprising providing continuous, real-time monitoring of a patient's vital signs.

9. The method of claim 1, further comprising calculating the momentum flux from data gathered from the signal arrays.

10. The method of claim 9, further comprising calculating a patient's vital signs from the momentum flux.

11. The method of claim 1, wherein the vital sign is blood pressure.

12. A radiation stress, non-invasive vital sign monitoring device comprising:

a discretized array for measuring acoustic, electromechanical, or other physiological signals from a patient,

a surface of the discretized array for contacting a patient,

a transmission system for data collected by the discretized array,

a computing device for receiving data from the discretized array and calculating values of vital signs.

13. The monitoring device of claim 12, wherein the discretized array collects data over a range of frequencies or in a single frequency.

14. The monitoring device of claim 12, wherein the data is collected in a time domain or frequency domain.

15. The monitoring device of claim 12, wherein a patient lies on, stands on or otherwise engages the discretized array.

16. The monitoring device of claim 12, wherein the transmission system transmits a voltage signal via wire, fiber optics or wirelessly.

17. The monitoring device of claim 12, wherein a non-time series is used for determining

energy at various array points or combinations of array points.

18. The monitoring device of claim 12, wherein the computing device calculates momentum flux from the collected data.

19. The monitoring device of claim 18, wherein the computing device converts the momentum flux to a value for a vital sign through a mathematical relationship.

20. The method of claim 12, wherein continuous, real-time monitoring of a patient's vital signs is provided by the discretized sensor array.

ABSTRACT

The invention determines the energy dispersion via acoustic, electromechanical or other related physiological signals collected from a patient that lies down or otherwise engages a digitized sensing array. Signals are monitored over a range of frequencies and collected in the time domain or frequency domain. A computing machine determines the energy from the signal measured over various elements of the array and calculates the momentum flux. Blood pressure is determined directly from the momentum flux calculation.

Figure 1

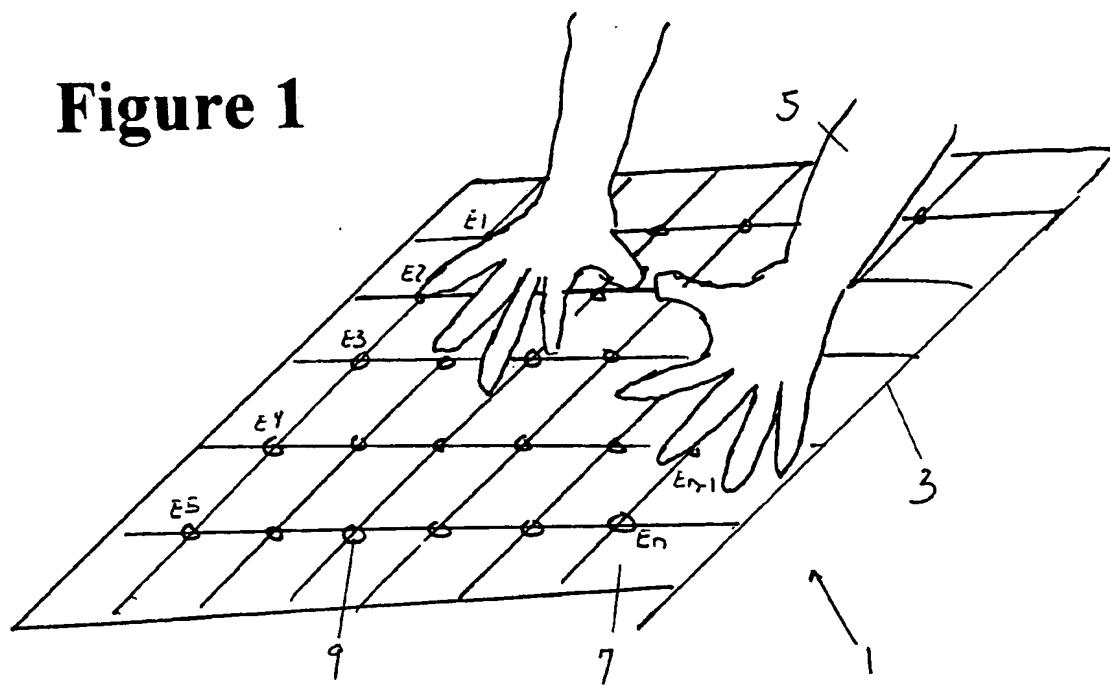
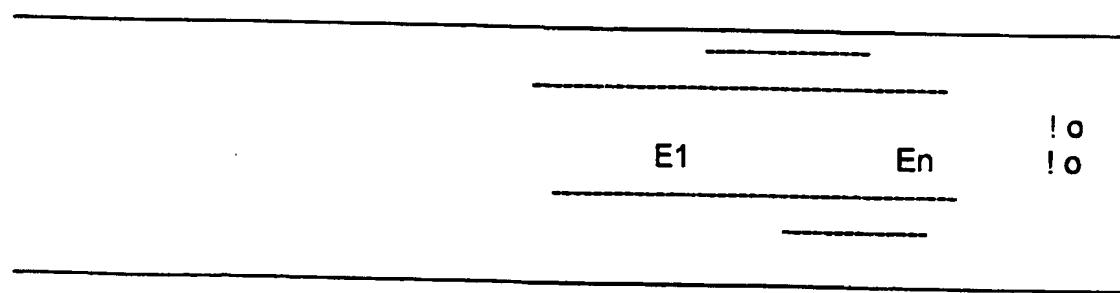


Figure 2



E_1 = energy spectra collected from location 1
 E_n = energy spectra collected from location n

Figure 3

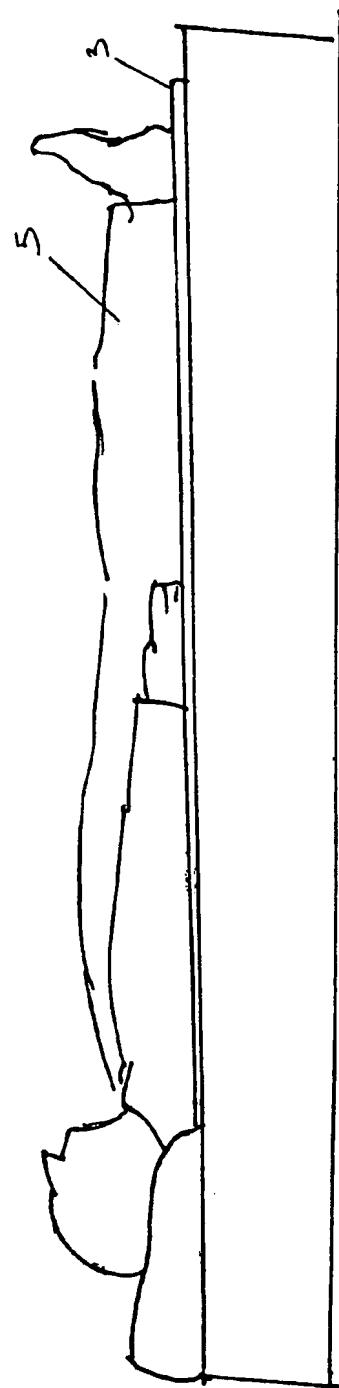


Figure 4

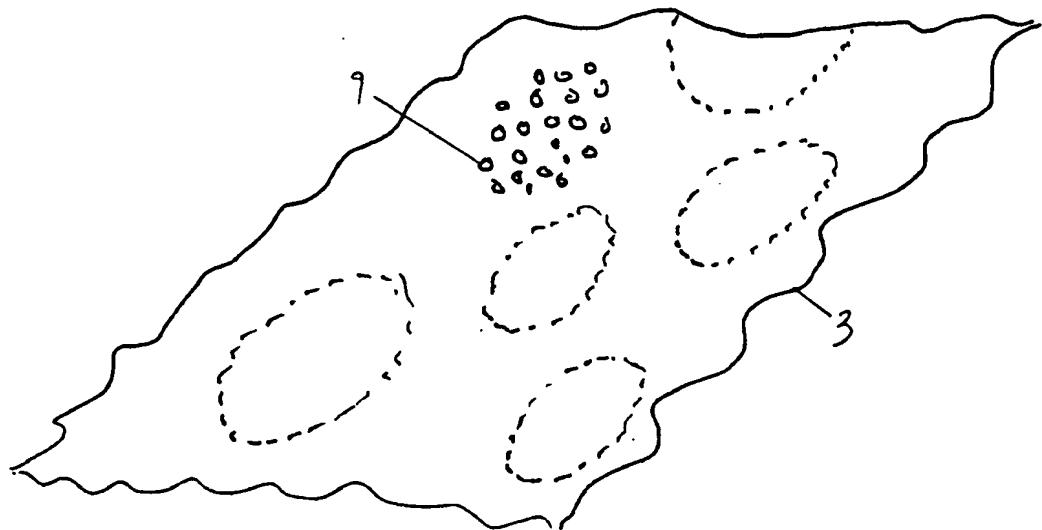


Figure 5

